

I do believe the punitive arena must be tremendously stronger than that of the ADA. This is supported by the facts that the ADA was signed into law many years ago, yet the majority of America is still not accessible to people with disabilities. Want proof, run a check on just the hotels or restaurants in Washington, D.C.!

# 40.

On this point I would refer back to my statements on # 39., and the points of joint responsibility solutions in regards to purchasing and selling thereof. I would think this would be the most effective of solutions.

In closing I would again be readily available to provide further documentation and input in this arena, please let me know if I can be of further assistance.

Sincerely,



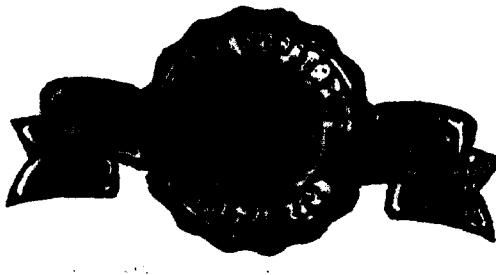
Jo Waldron  
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December 27, 1995

To: Dr. Jack Wojcik  
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From: Slawek Wycech  
APREL Laboratories

APREL Task No.: PHXB-HATIS-2507

**REPORT No. 2507**

**Subject:** Evaluation of Magnetic Field Strength, Distribution and Frequency Response Generated Around Hearing Aid Magnetic Coupler HATIS

**INTRODUCTION**

Evaluation of the properties of magnetic field generated by HATIS was conducted at APREL Laboratories. The Test Procedure, described in this document, was prepared by APREL Laboratories. When appropriate, the FCC Part 68 and IEEE 1027 procedures were observed.

**TEST PROCEDURES**

A reference telephone, AT&T R2500DMG, was connected to a Central Office Simulator (C.O.S.). The Landline System was connected between the base of the telephone and the handset of the telephone.

The System was switched to position "Phone". Test signal of -12 dBV open circuit was supplied to the C.O.S. Acoustic output from reference and amplified handsets was measured.

Magnetic field around the ear cap of the reference unamplified handset was scanned using a Magnetic Field Probe, part of a Magnetic Field Scanner TOMMI. Distance from the ear cap plane and scanning coil was 10 mm. This distance simulates typical distance between ear cap plane and behind-the-ear (BTE) hearing aid. Also, maximum magnetic output from amplified handset was measured.

The Landline System was switched to the "Aid" position and magnetic field level around T-Coupler was scanned. The scan was conducted with unamplified handset connected to the switch box. Reference measurement at axial and radial maximums were conducted with amplified handset connected to the switch box. The reference distance between surface of the T-Coupler and the Magnetic Field Probe was 6 mm. This distance represents typical distance between geometrical centres of T-Coupler and hearing aid.

HATIS Cellular System was verified for its magnetic output with two available samples of cellular telephones, Panasonic EB-H20 and Ericsson EH-220. Both cellular phones were verified for their acoustic outputs at nominal and maximum gain settings. Cellular Test System Wavetek 3600D was used to put telephones in the call mode. In a call mode a 1 kHz test signal modulated with  $\times 2.9$  kHz was sent to the telephones.

After acoustic output verification, the HATIS Cellular System was connected to the audio connector of each of the cellular telephones respectively. Magnetic Field Probe was located at co-ordinates where Landline System T-Coupler produced maximum magnetic output. The level was measured at volume control set to nominal and maximum.

During the scanning process the HATIS T-Couplers and handset ear cap were mounted under grid calibrated in 5 mm steps and having dimensions 50 mm width and 110 mm length.

## TEST RESULTS

Numerical results of acoustic output and magnetic field levels are shown in Table 1, attached.

Charts presenting magnetic field distribution are included in this report. Charts 1 and 2 are showing 3-D distribution

of the resultant of magnetic field. The resultant field was calculated from individual vector components. The spatial distributions for individual components are given in Charts 3 to 8. Charts 9 to 16 are showing distribution of magnetic field components at the surface corresponding to a likely distance between hearing aid and the magnetic field source device.

Chart 17 represents voltage induced in the probe located in the magnetic field generated by a HAC telephone and by HATIS T-Coupler respectively. The 6 dB/oct output increase corresponds to a "flat" characteristic of magnetic field.

## CONCLUSIONS

It may be concluded that:

- Reference telephone AT&T 2500DMG, equipped with unamplified handset, meets requirements of FCC Part 68 Standard for hearing aid compatibility.
- Frequency response of the magnetic field generated by HATIS Landline/Cellular Systems with T-Coupler is "flat" and represents better balance between low and high frequency ranges. Response of receiver U3 shows loss of high frequencies. Graph 17 shows frequency responses of receiver U3 and HATIS. It has to be noted that the curves show voltage response and not actual magnetic field (6 dB/oct slope difference).

## CONCLUSIONS continued

- Magnetic field distribution around HATIS coil is more irregular than distribution of magnetic field produced by an average U3 receiver providing several positions for coupling optimisation.
- HATIS Landline System with T-Coupler produces maximum magnetic output 15 dB higher than an U3 type receiver installed in a G3 handset.
- HATIS Cellular System with T-Coupler, with cellular telephone volume control at nominal setting, produces maximum magnetic output approx. 20 dB higher than an average U3 receiver used in the land network.
- HATIS Landline System was verified for its operation in conjunction with an amplified handset type G6. With switch in position "Phone" magnetic output from the T-Coupler was not observed. With switch in position "Aid" magnetic output from T-Coupler was observed. Handset receiver was not muted and acoustic output was 3 dB lower than with the switch in position "Phone". Magnetic output from the T-Coupler varied only by 6 dB with respect to full volume control adjustment.

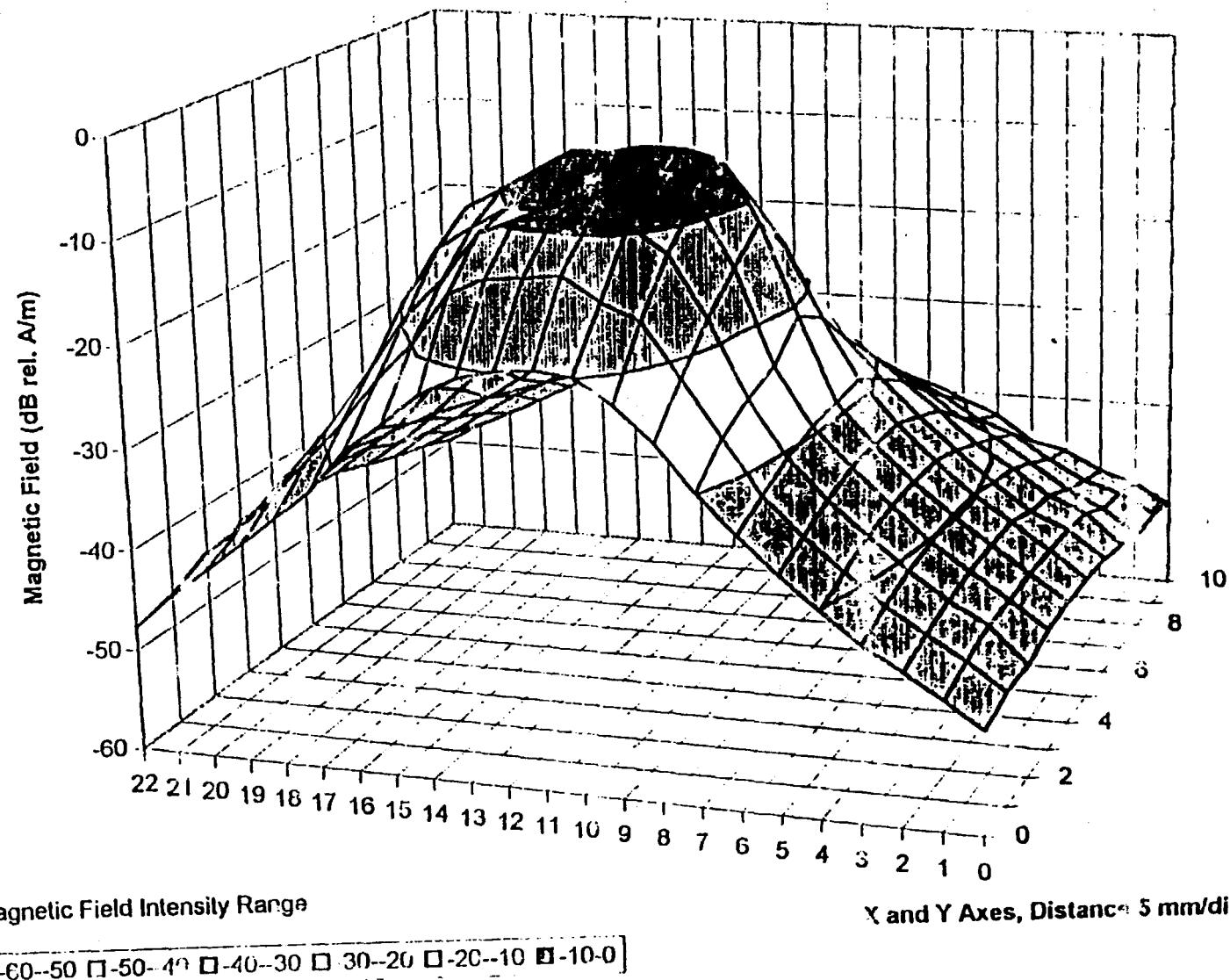
All experiments were carried out at APREL Laboratories, between November 15 and December 25, 1995.

**TABLE I TEST RESULTS**

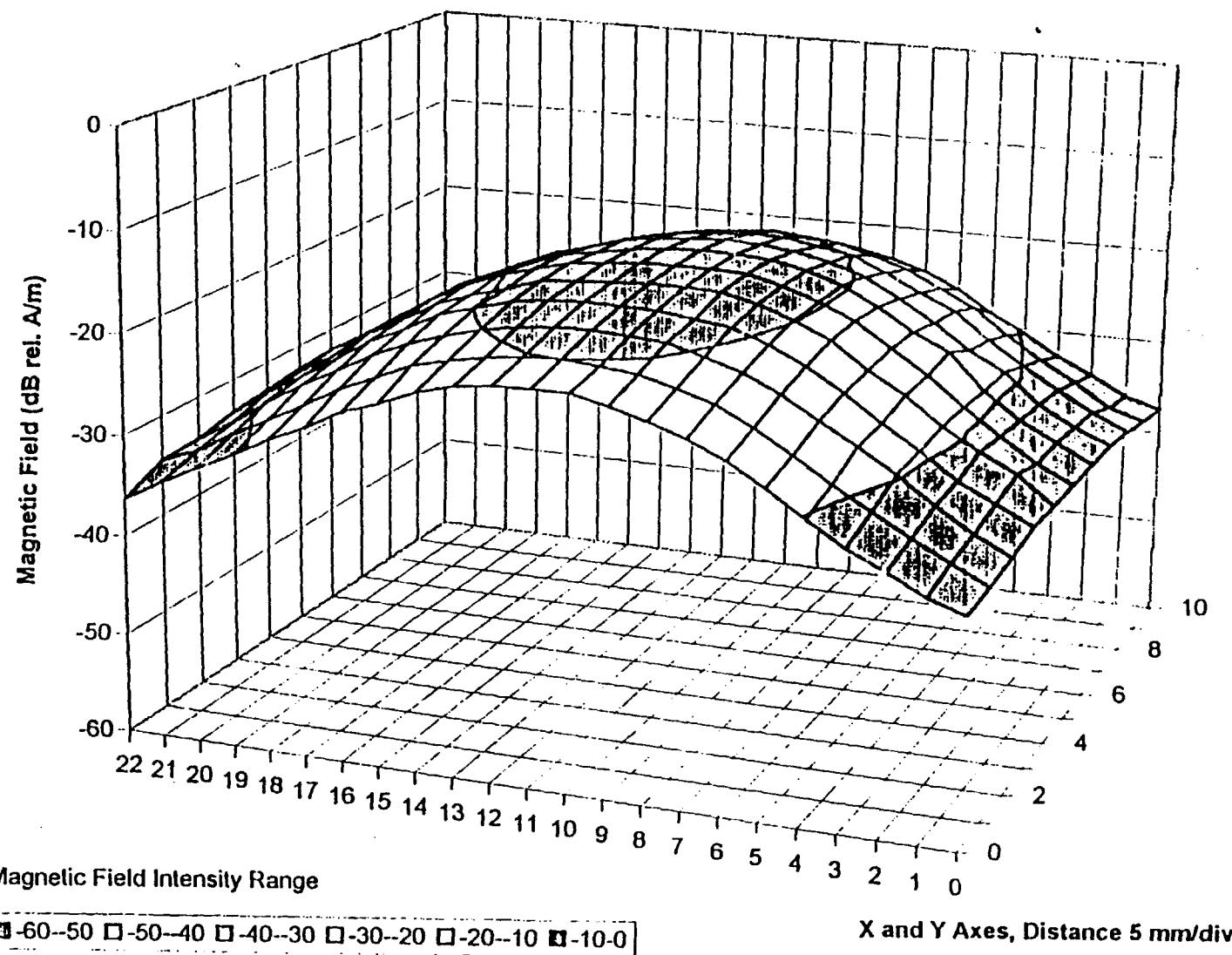
Measured Sample	Coupling to Magnetic Field Probe	Level (dB rel. A/m)	Field Orientation	Acoustic Output (dBSPL)
AT&T 2500, Handset G3 with U3 receiver	Direct	-22.0 -26.0	Axial Radial	90
AT&T 2500, Handset G6 with U3 receiver, volume control maximum	Direct	2.0 -4.0	Axial Radial	111
AT&T 2500, Handset G6 with U3 receiver, volume control minimum	Direct	-22.0* -28.0*	Axial Radial	90*
AT&T 2500, Handset G6 with U3 receiver, volume control maximum	Direct, with HATIS connected, switch in Aid position	-1.0 -7.0	Axial Radial	108
AT&T 2500, Handset G6 with U3 receiver, volume control maximum	HATIS	-12.0 -18.0	Axial Radial	108
AT&T 2500	HATIS Landline System with T-Coupler	-7.0 -11.0	Axial Radial	90
Panasonic EB-H20, nominal volume control, $\leq$ 2.9 kHz deviation	HATIS Cellular System with T-Coupler	0.0 -2.0	Axial Radial	92
Panasonic EB-H20, maximum volume control, $\geq$ 2.9 kHz deviation	HATIS Cellular System with T-Coupler	8.0 6.0	Axial Radial	100
Ericsson AH220, nominal volume control, $\leq$ 2.9 kHz deviation	HATIS Cellular System with T-Coupler	1.5 -0.5	Axial Radial	-
Ericsson AH220, maximum volume control, $\geq$ 2.9 kHz deviation	HATIS Cellular System with T-Coupler	13.5 12.0	Axial Radial	97
AT&T 2500 with Neck Loop	Direct, 15 cm above	-48.0	Axial	90

\* Intermittent operation of volume control at lowest setting

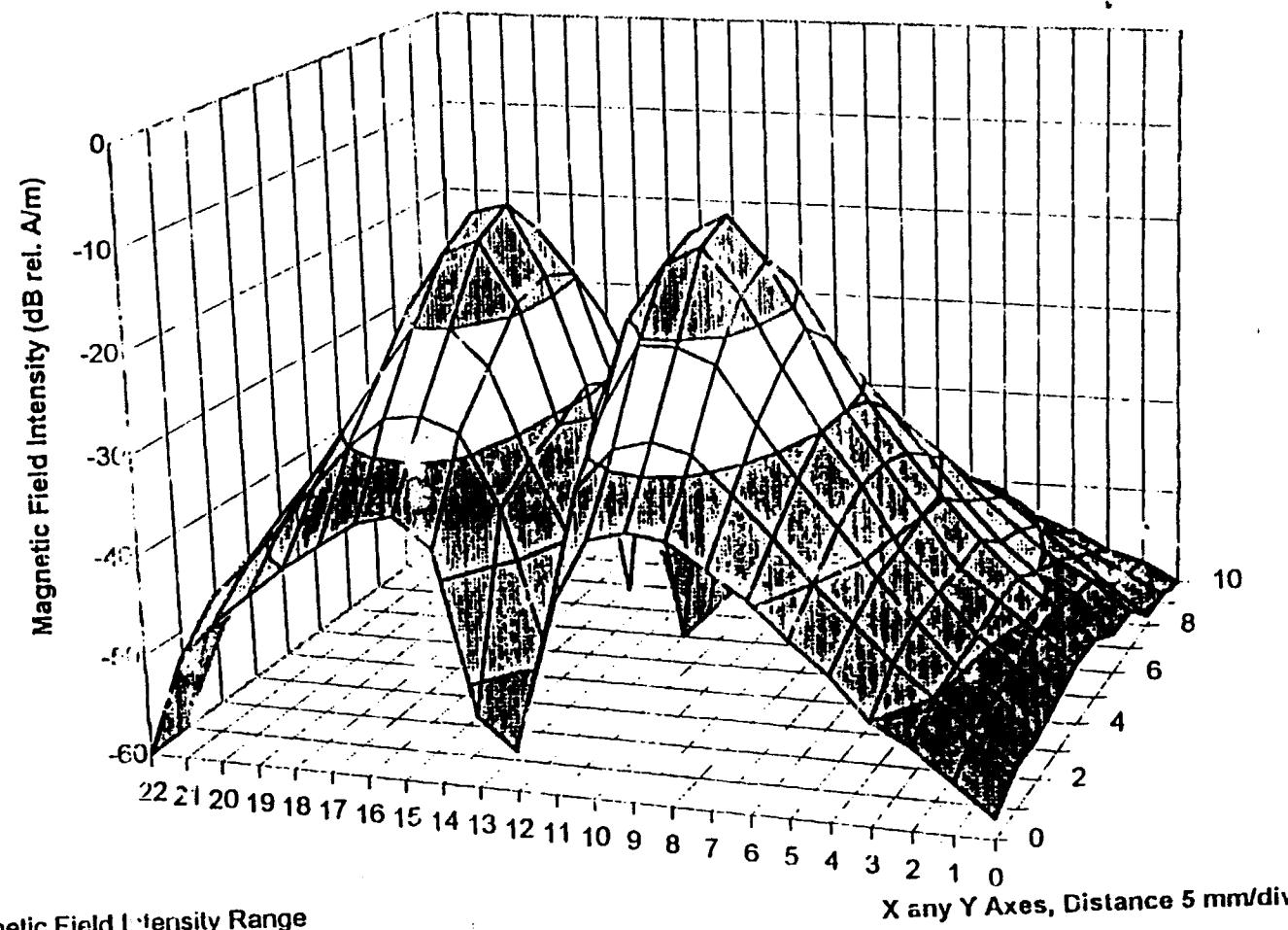
Graph 1. HATIS. Magnetic Field Distribution. Resultant.



Graph 2. Reference Telephone AT&T 2500DMG, G3 Handset, U3 Receiver.  
Magnetic Field Distribution. Resultant.



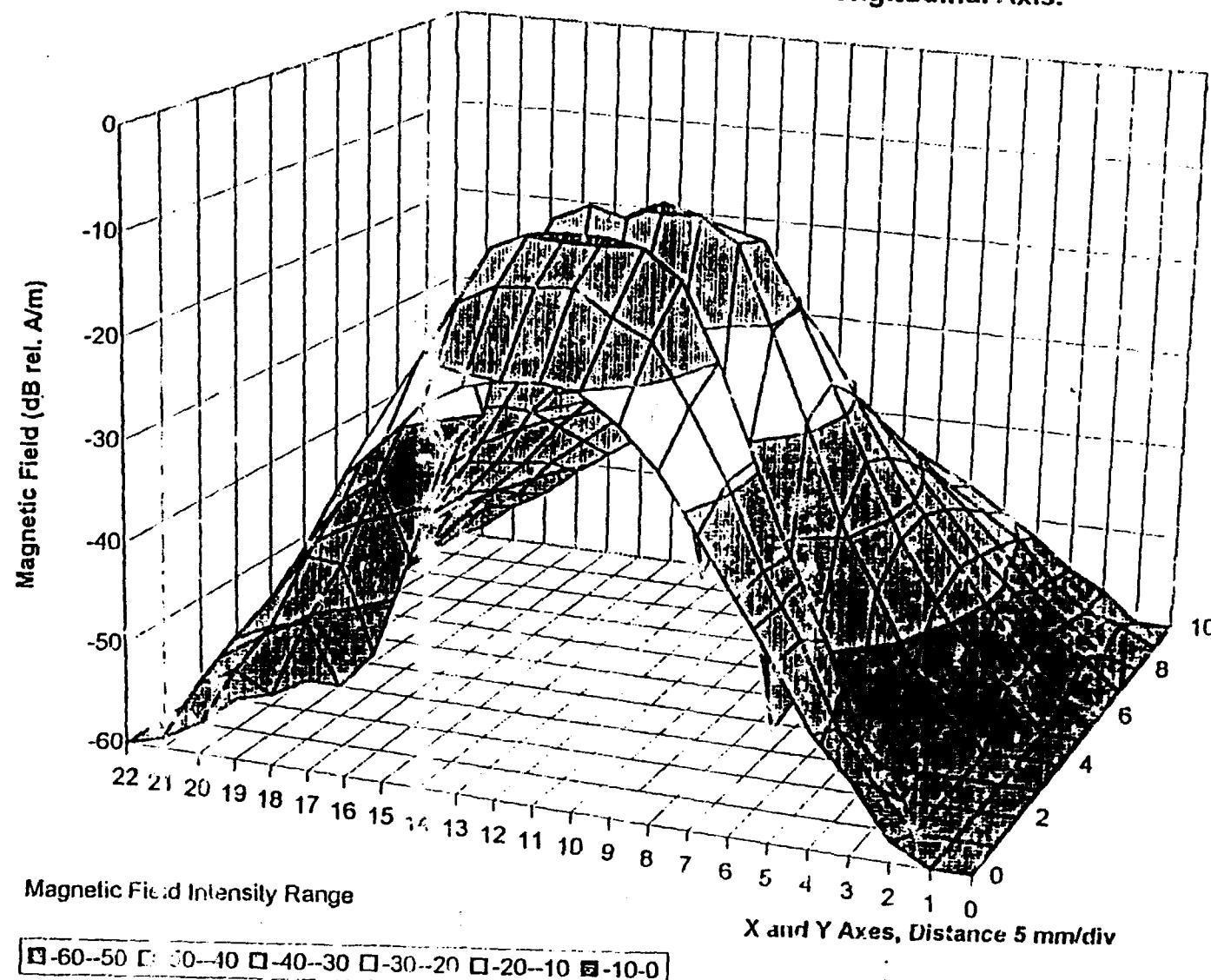
**Graph 3. HATIS. Magnetic Field Distribution.  
Radial Component Scanned Along Longitudinal Axis.**



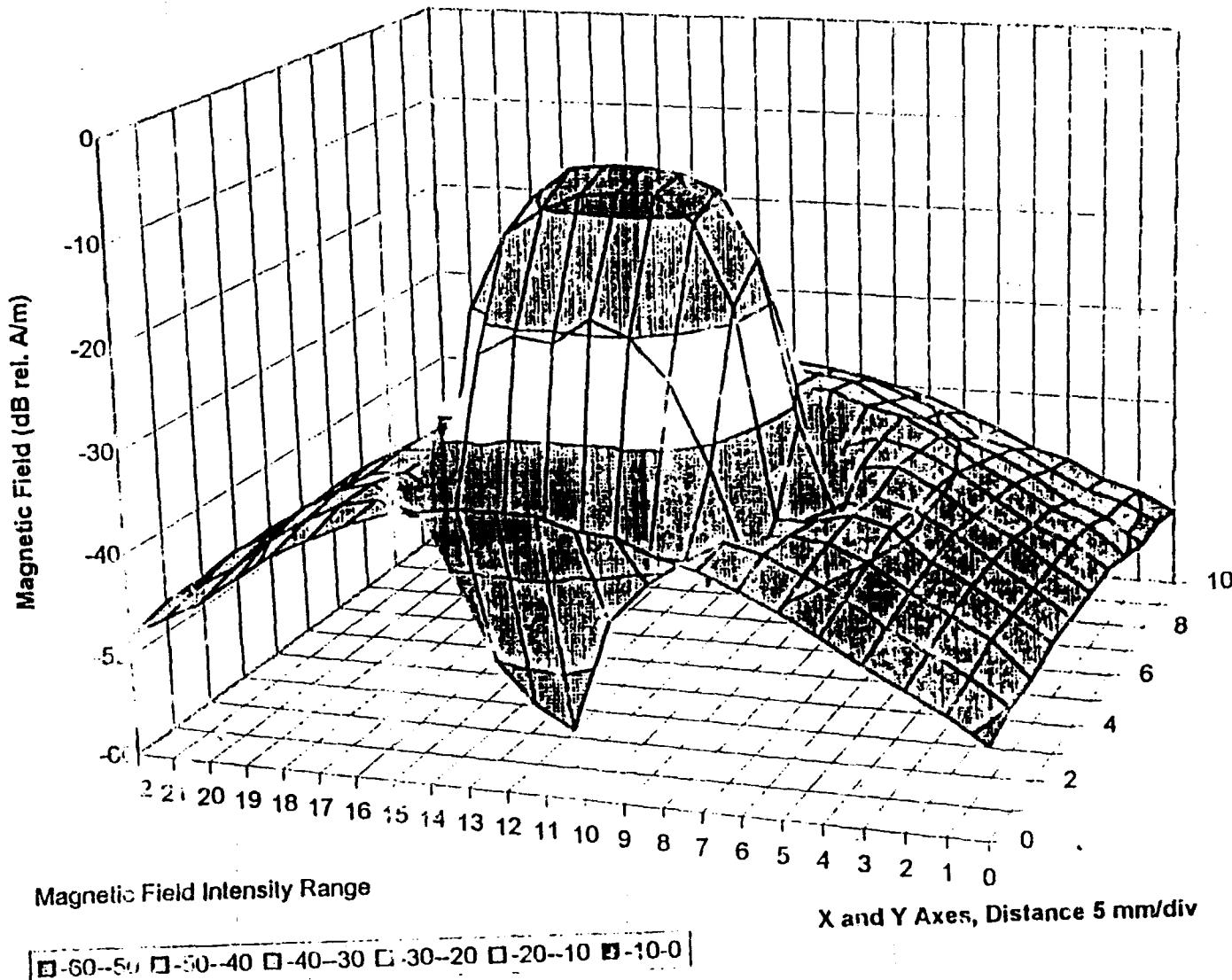
Magnetic Field Intensity Range

■ -60-50 □ -50-40 ▨ -40-30 □ -30-20 □ -20-10 ■ -10-0

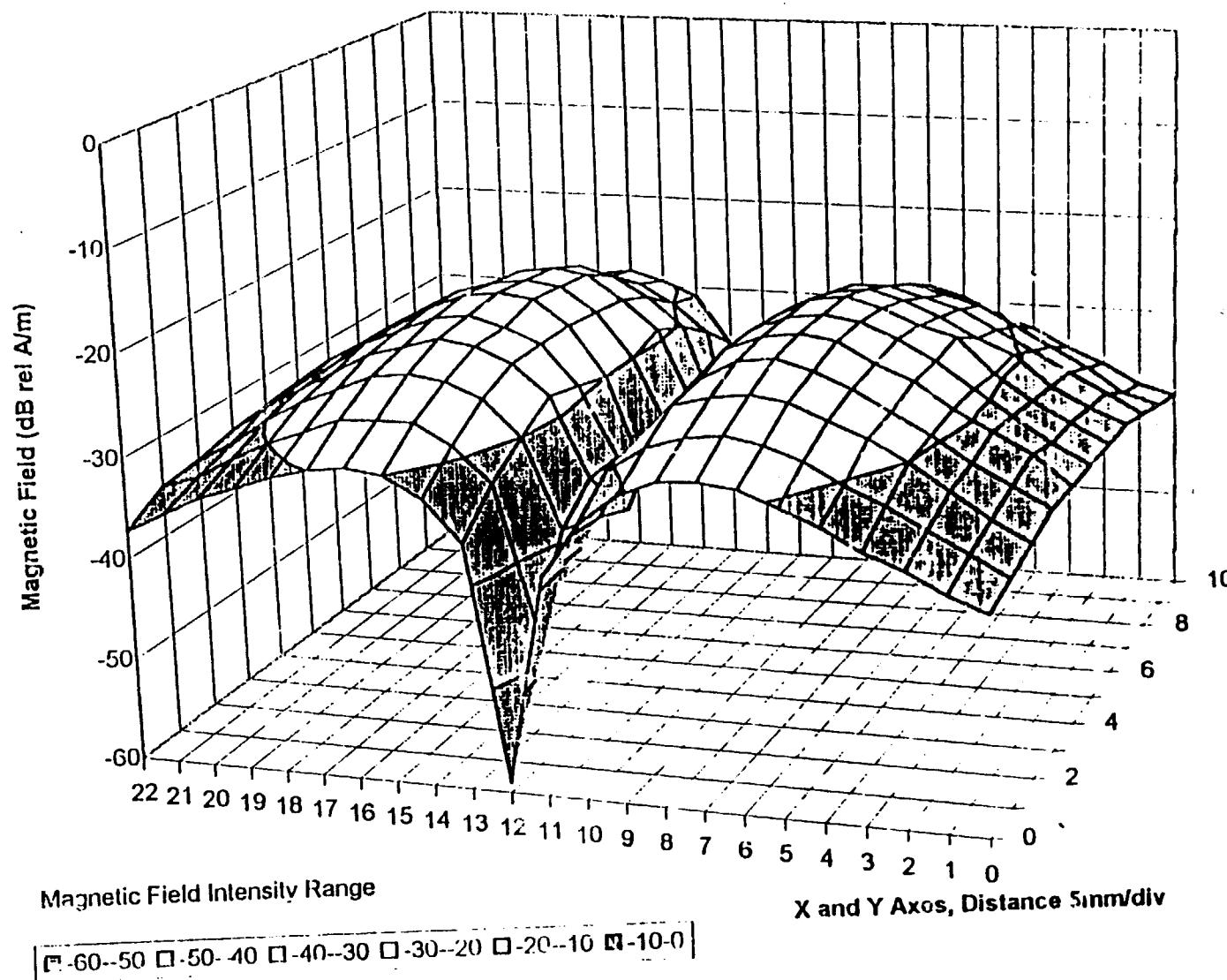
Graph 4. HATIS. Magnetic Field Distribution.  
Radial Component Scanned Across Longitudinal Axis.



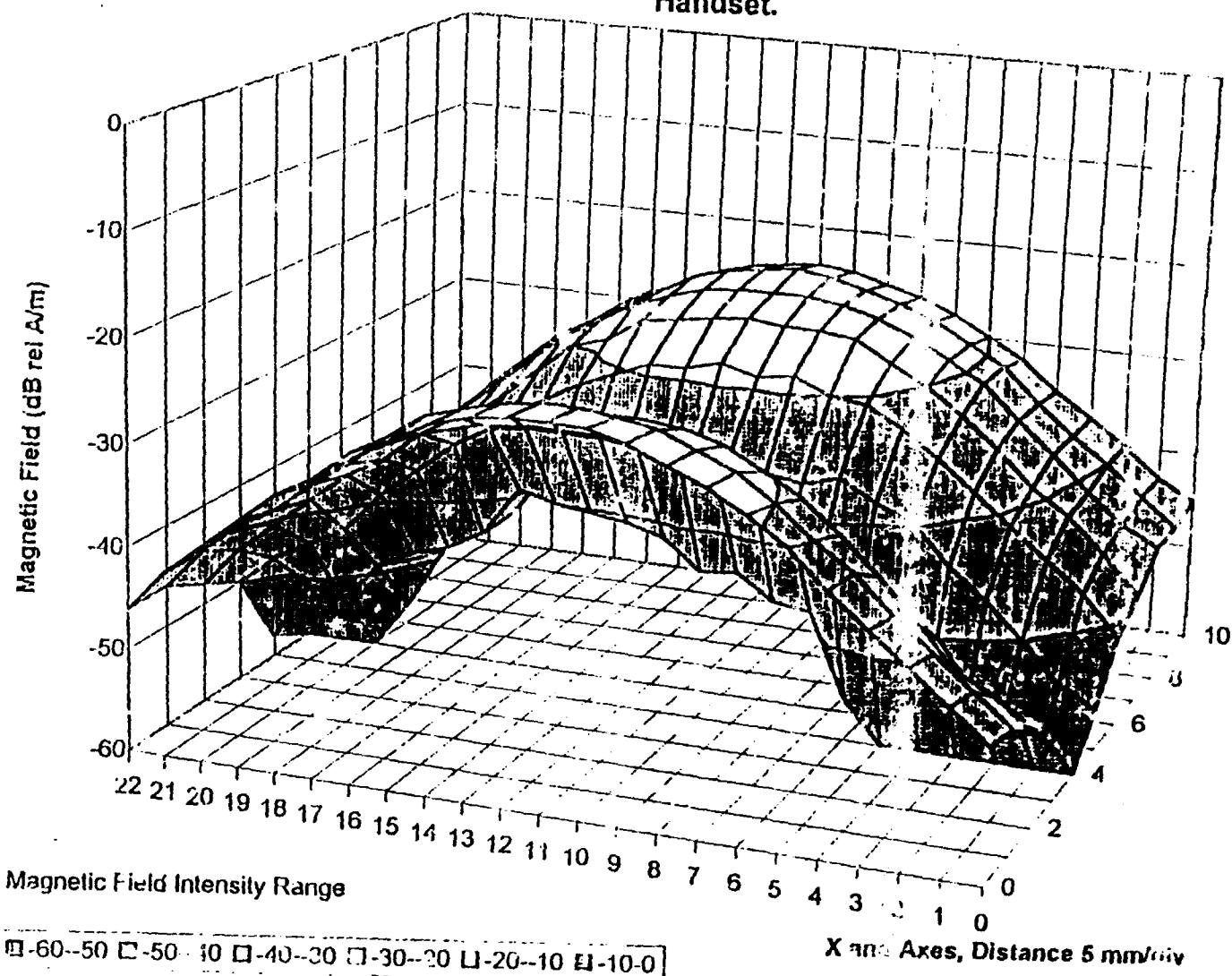
Graph 5. HATIS. Magnetic Field Distribution.  
Axial Component.



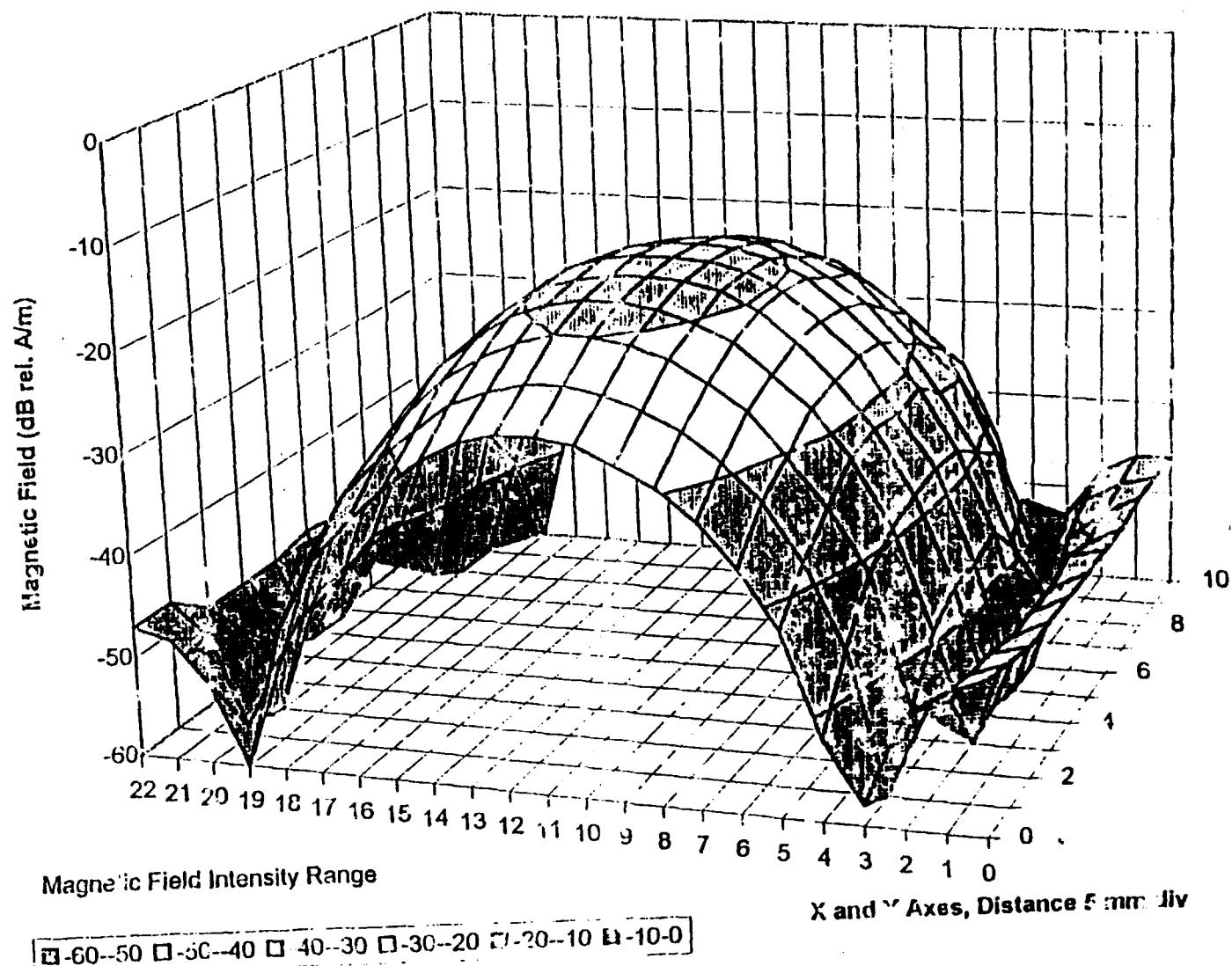
Graph 6. Reference Telephone, G3 Handset, U3 Receiver.  
Magnetic Field Distribution. Radial Component Scanned Along Longitudinal Axis of the  
Handset.



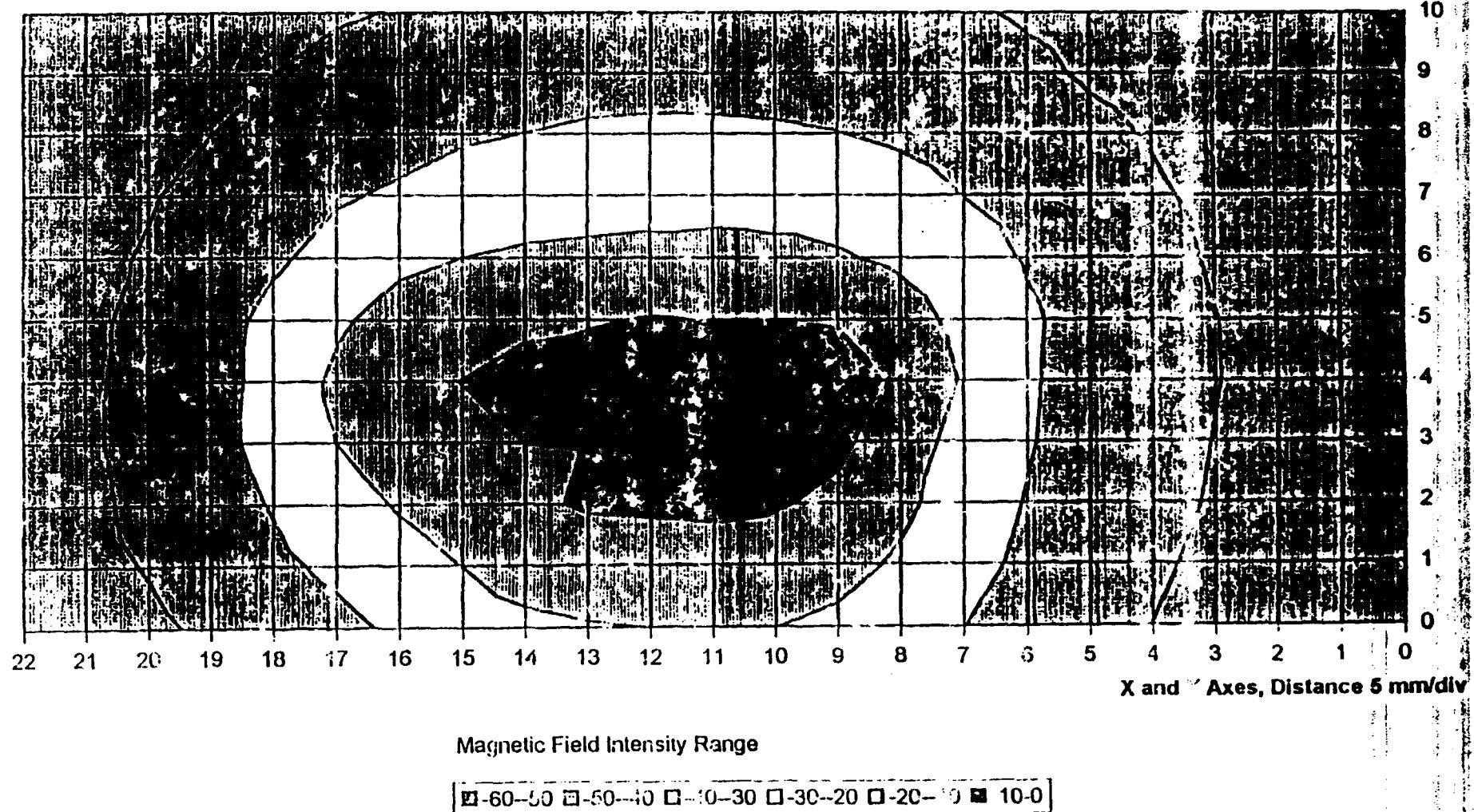
Graph 7. Reference Telephone, G3 handset, U3 Receiver.  
Magnetic Field Distribution. Radial Component Scanned Across Longitudinal Axis of the  
Handset.



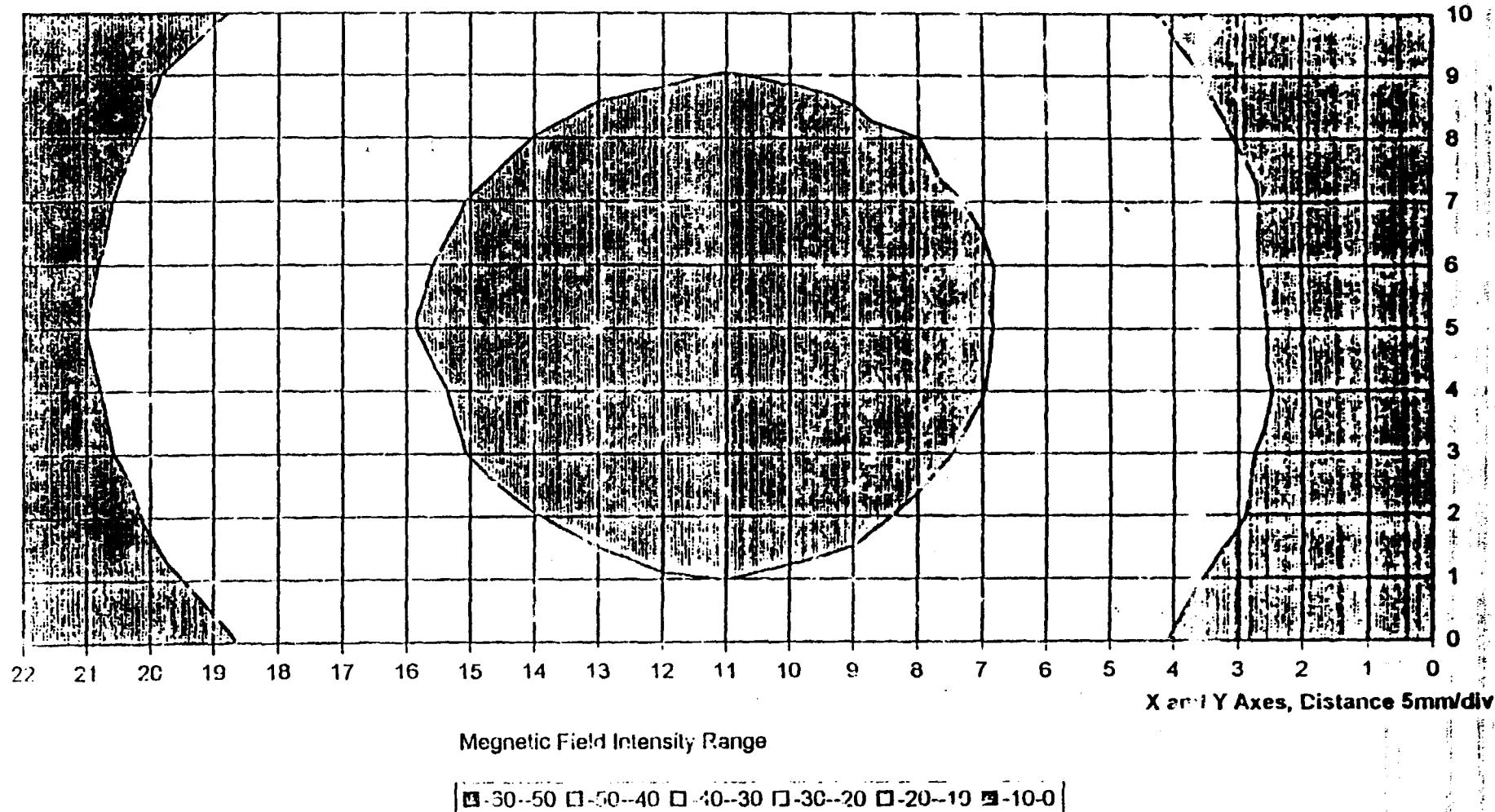
Graph 8. Reference Telephone AT&T 2500DMG, G3 Handset, U3 Receiver.  
Magnetic Field Distribution. Axial Component.



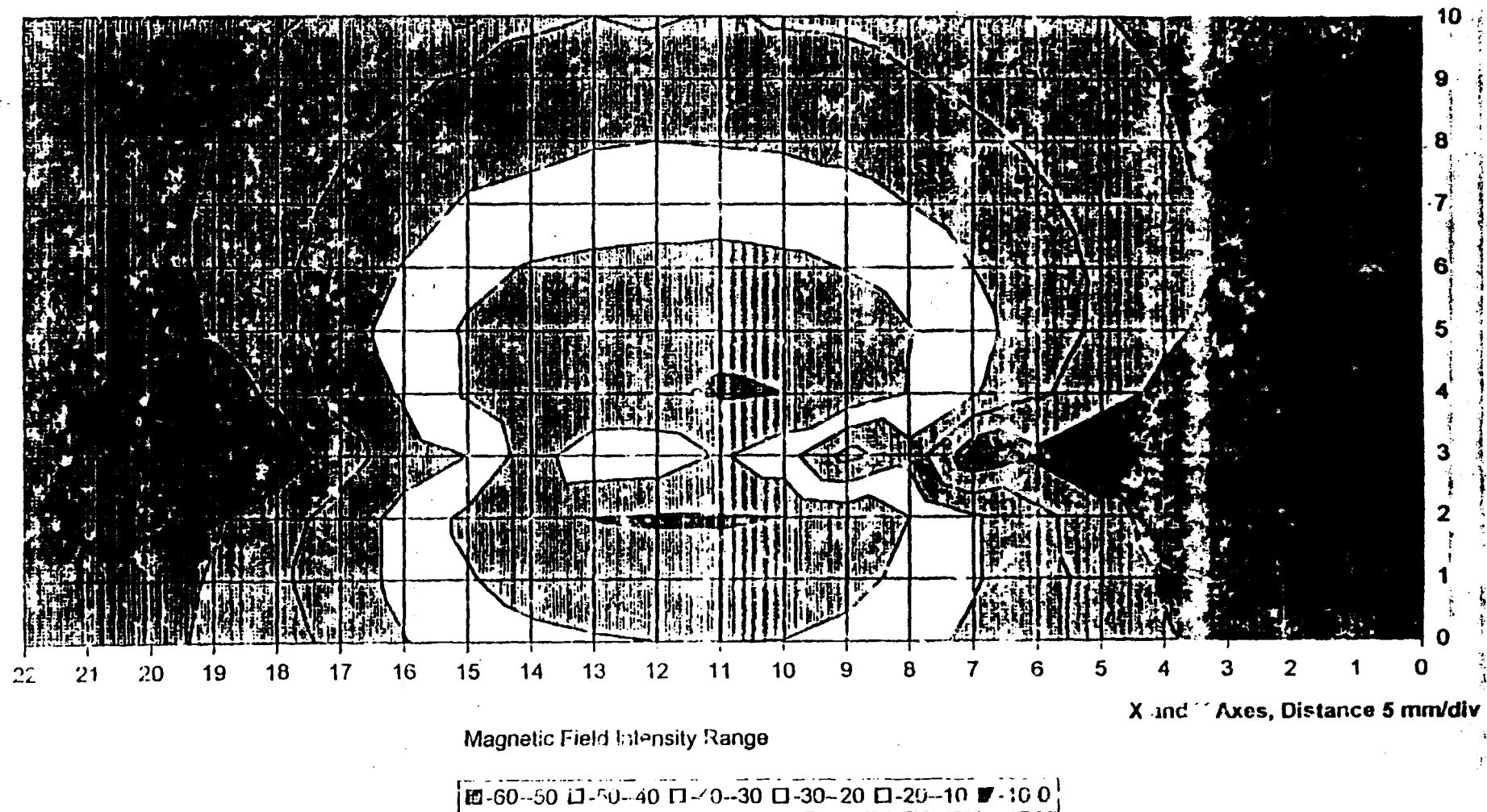
Graph 9 HAIIIS. Magnetic Field Distribution. Resultant.



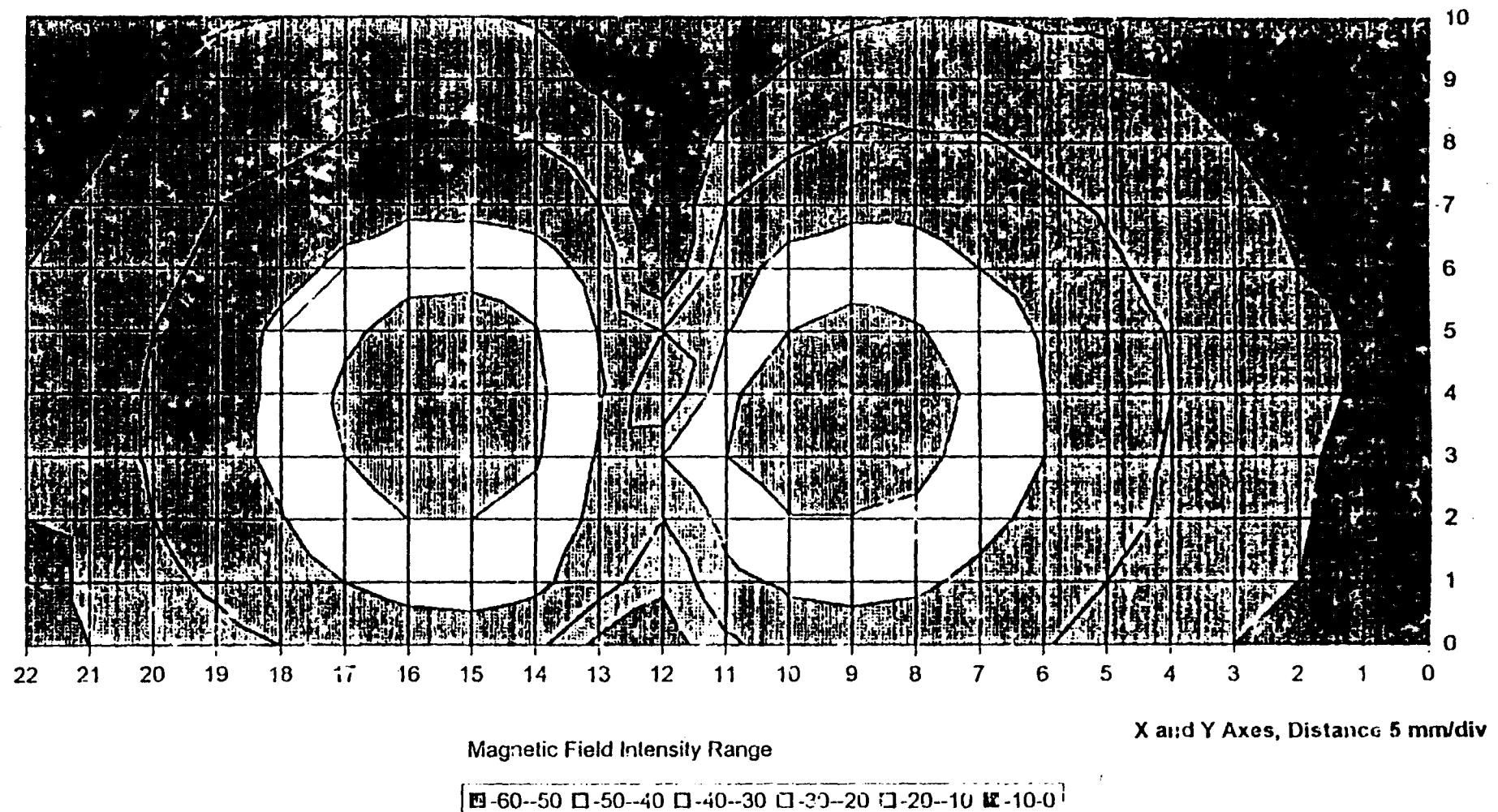
Graph 10. Reference Telephone AT&T 2500PMG, G3 Handset, U3 Receiver Magnetic Field Distribution. Resultant.



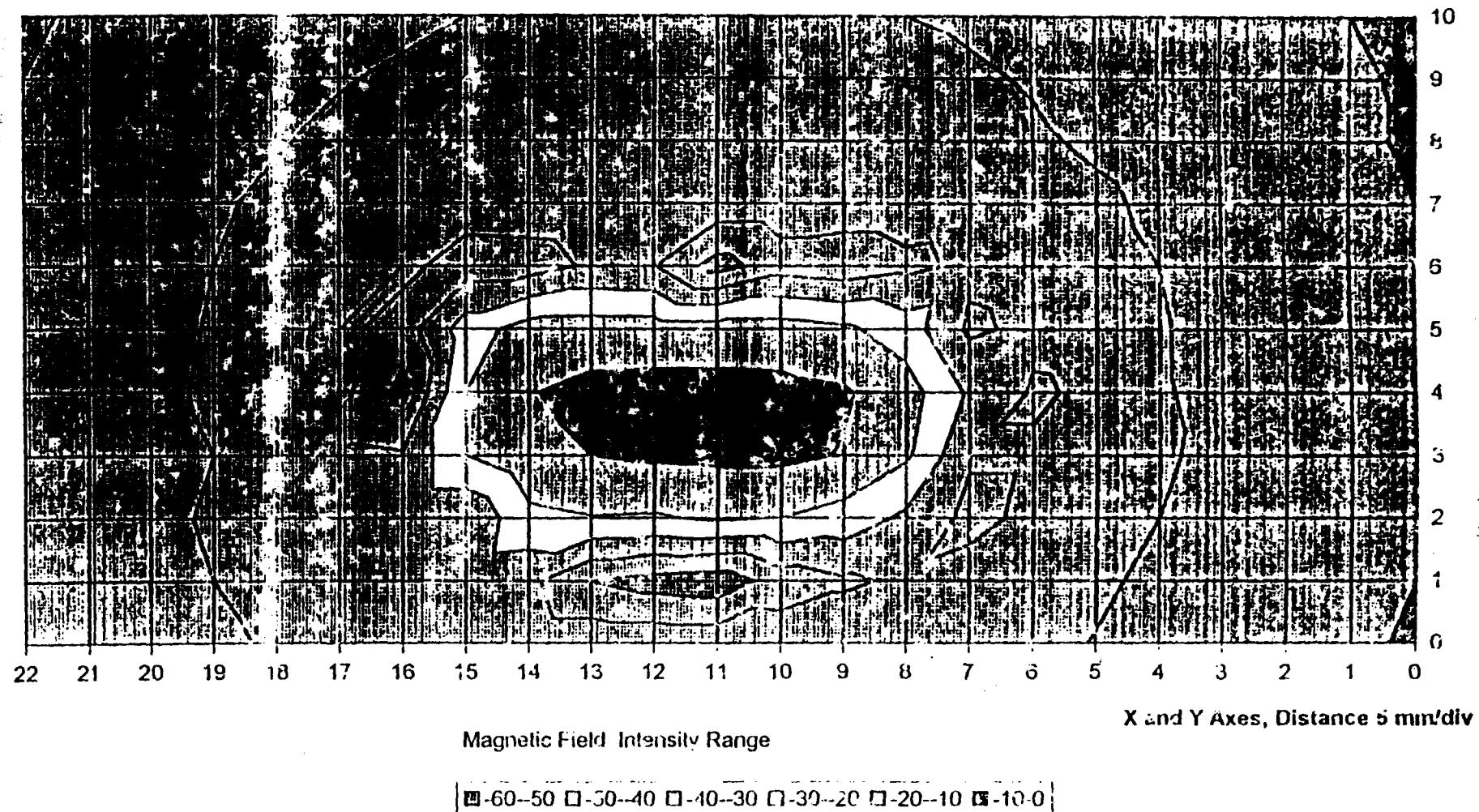
Graph 12. HATIS. Magnetic Field Distribution.  
Radial Component Scanned Across Longitudinal Axis.



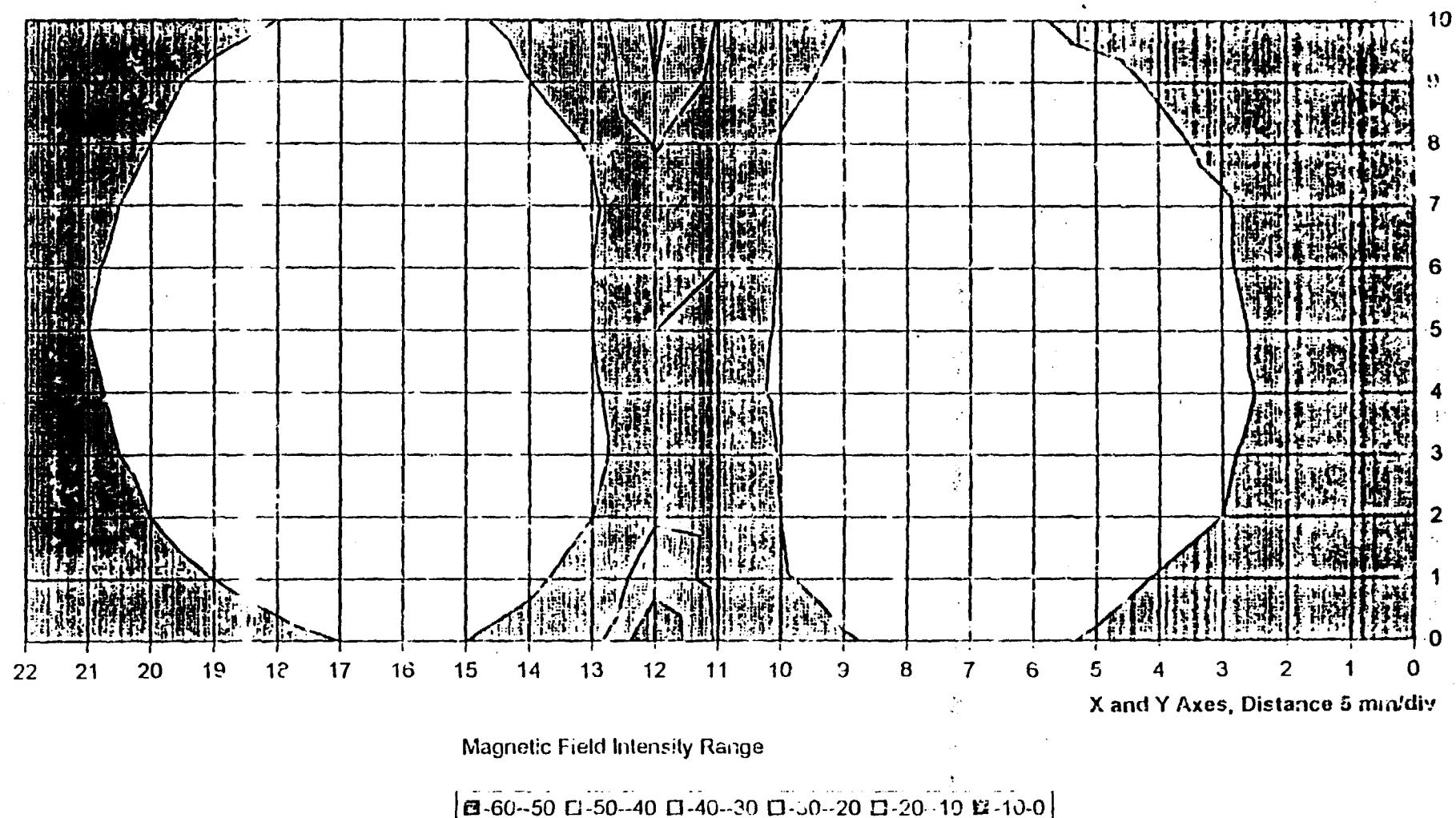
Graph 11. HATIS. Magnetic Field Distribution.  
Radial Component Scanned Along Longitudinal Axis.



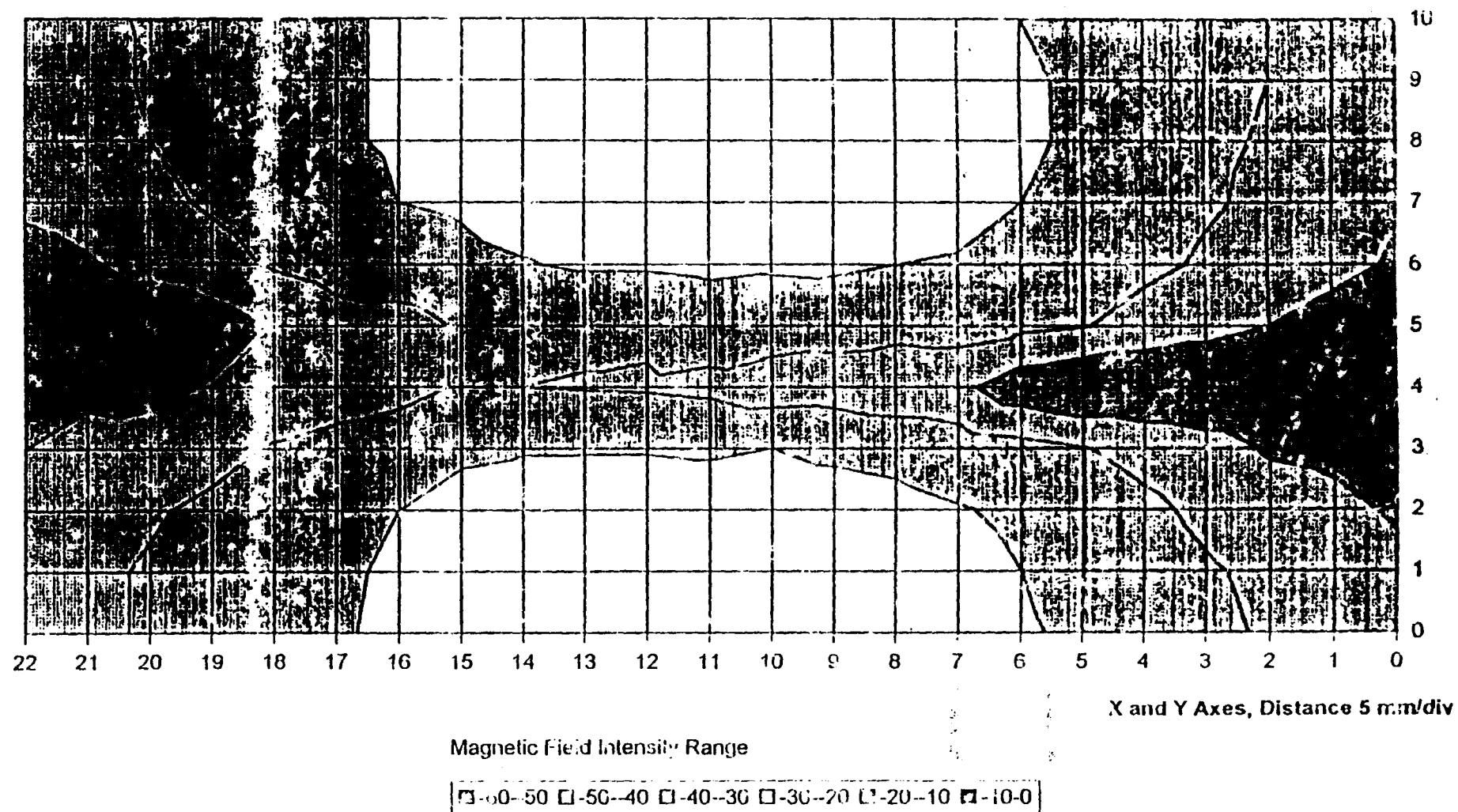
Graph 13. HATIS. Magnetic Field Distribution.  
Axial Component.



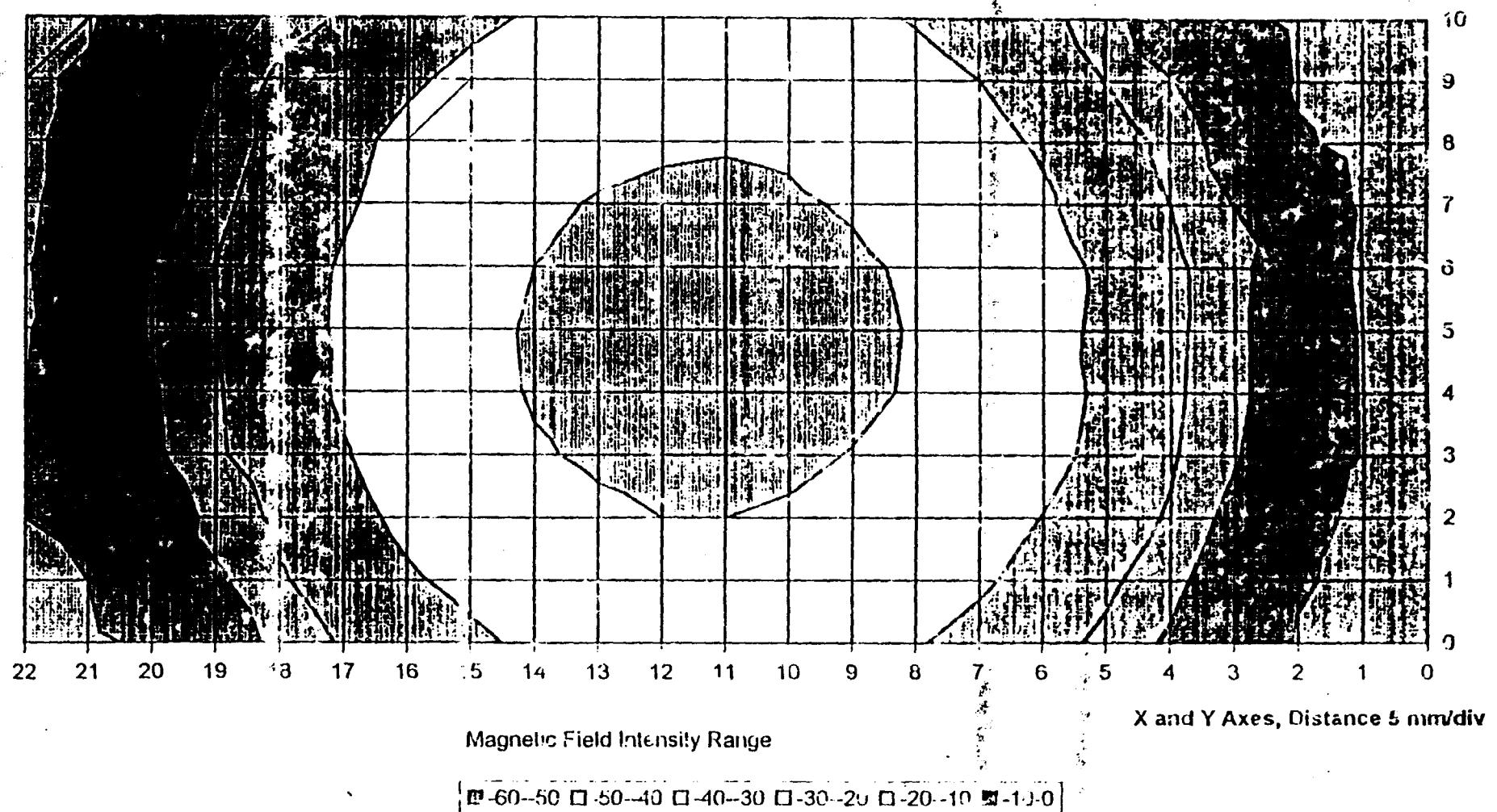
Graph 4. Reference Telephone AT&T 2500DMG, G3 Handset, U3 Receiver. Magnetic Field Distribution. Radial Component Scanned Along Longitudinal Axis of the Handset.



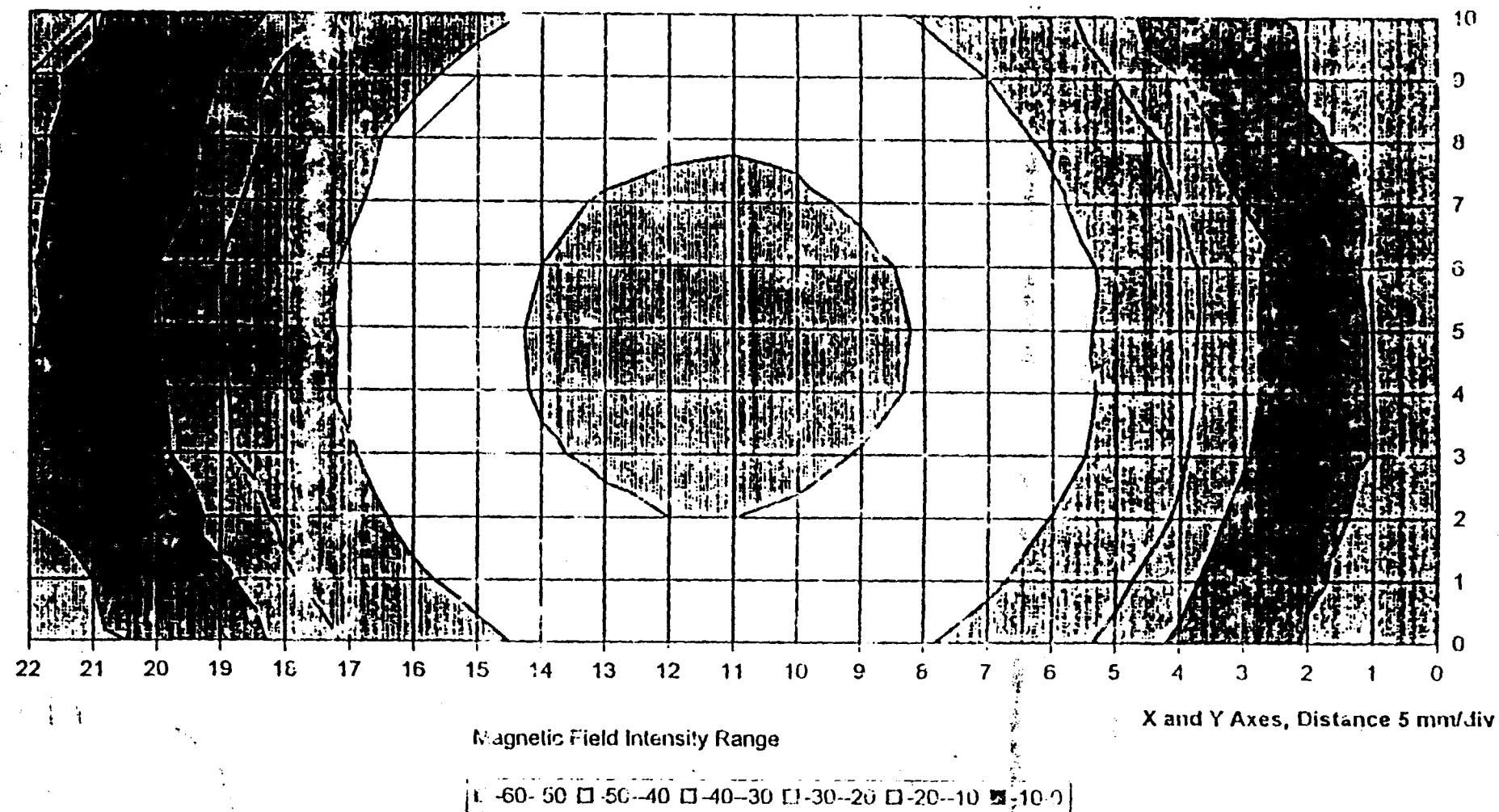
Graph 10. Reference Telephone AT&T 2500DMG, G3 handset, U3 Receiver. Magnetic Field Distribution. Radial Component Scanned Across Longitudinal Axis of the handset.



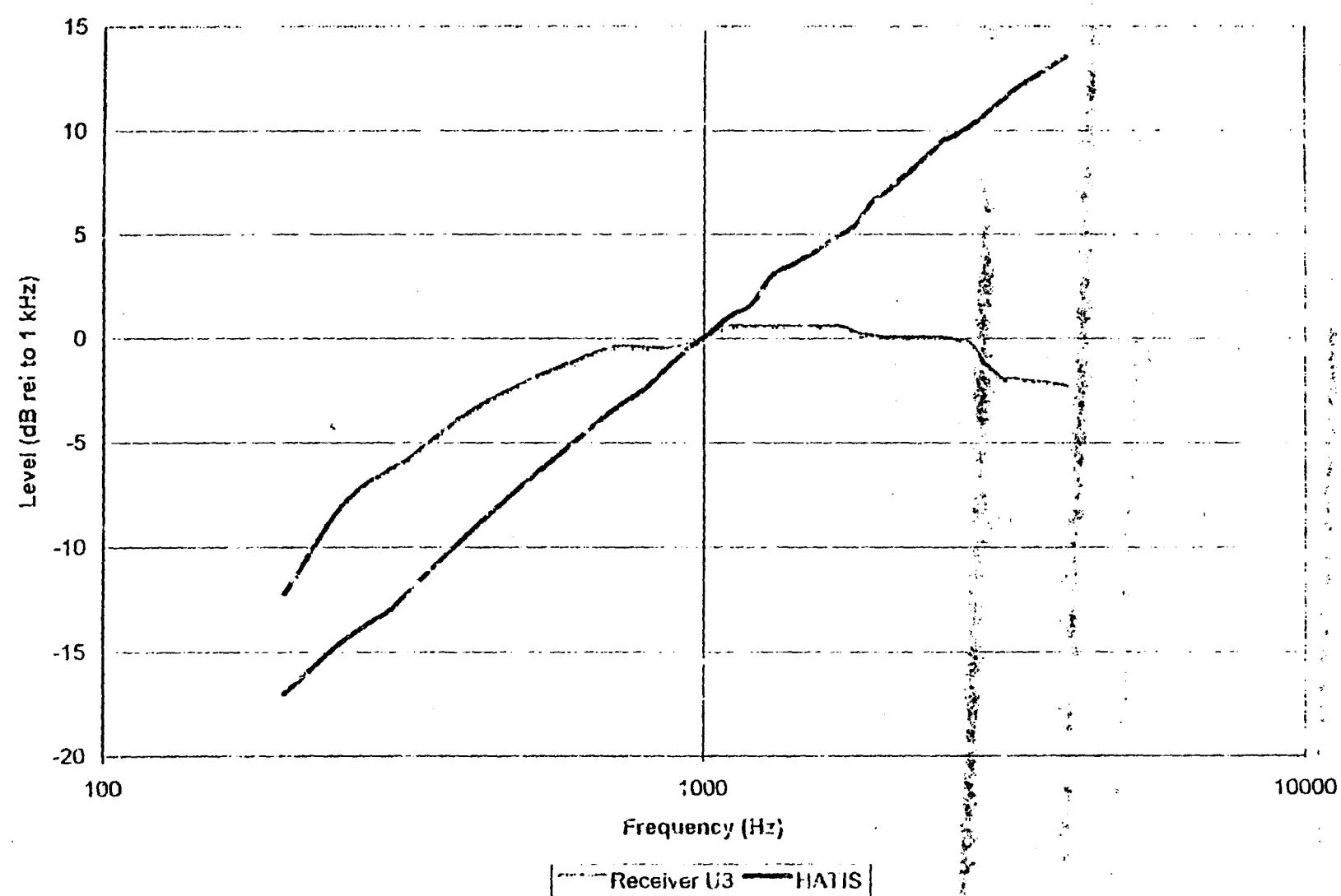
Graph 16. Reference Telephone AT&T 2500DMC, G3 Handset, U3 Receiver. Magnetic Field Distribution. Axial Component.

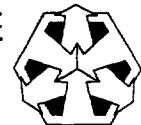


Graph 16. Reference Telephone AT&T 2500DMG, G3 Handset, U3 Receiver. Magnetic Field Distribution. Axial Component.



**Graph 17. Frequency Response of Voltage  
Induced in the Magnetic Search Probe**





Research Program - Hearing Aid Compatibility

## THE FACTS ABOUT BYSTANDER INTERFERENCE FOR ERICSSON PCS 1900 CH 337 PHONE

Project performed by APREL Laboratories

Project team:

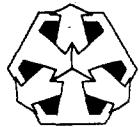
Dr. Jack J. Wojcik P.Eng (project leader)  
Dr. Paul Cardinal  
Slawek Wycech  
Janusz Lokaj

OCT 28 1996  
RECEIVED  
FCC MAIL ROOM

Objective: To determine safe distances from a PCS 1900 TDMA phone user and hearing aid user  
Method: APREL Labs Protocol PP-HAC 12  
Criteria: Annoyance level 55 dB SPL IRI per IEC 118-13 Standard

March 1996

SPECTRUM SCIENCES™ INSTITUTE



Research Program - Hearing Aid Compatibility

**THE FACTS ABOUT BYSTANDER INTERFERENCE  
FOR ERICSSON PCS 1900 CH 337 PHONE**

APREL LABORATORIES FINDING - SEE TABLE I

**NO BYSTANDER INTERFERENCE  
ABOVE 55 DB IRIL ("ANNOYING LEVEL" PER IEC 118-13)  
WAS OBSERVED AT DISTANCES  
GREATER THAN 6 INCHES  
FROM HEARING AID IN REAL USE**

March 1996